quisite entertainment from reading this book and noting its spirit, and then reflecting that the author was recently lectured publicly on elementary morality by a complacent spiritual descendant of the late Mr. Nupkins.

C. D. BROAD.

Perception, Physics, and Reality; an Enquiry into the Information that Physical Science can Supply about the Real. By C. D. BROAD, M.A., Fellow of Trinity College, Cambridge. Cambridge, University Press, 1914. Pp. xii, 388.

THIS book has a peculiar and unusual quality, in virtue of which it serves a purpose analogous to that which examiners are supposed to serve in education. It does not advance any fundamental novelties of its own, but it appraises, with extraordinary justice and impartiality and discrimination, the arguments that have been advanced by others on the topics with which it deals. Mr. G. E. Moore's *Refutation of Idealism* is awarded an Alpha-minus (*cf.* p. 177 *n.*); the rest of us receive such betas and gammas as we deserve, except Locke, who I think may be said to be ploughed.

Locke is the chief victim in the first chapter, "on the arguments against naïf realism independent of the causal theory of perception". There is a long discussion of Locke's two hands in lukewarm water, ending, apparently, with the conclusion that whatever *prima facie* case this experiment may seem to establish against realism can be avoided through the assumption that hands are warmed by being put in cold water and cooled by being put in hot water, or through various other less plausible assumptions.

Mr. Broad's general attitude is that of one who wishes to defend realism, but finds the task difficult. As he proceeds, the arguments against realism grow more and more formidable. At the end, he is left with only a certain degree of probability in favour of a view which is only a pale shadow of the robust realism of common sense. Accepting from Mr. Moore the importance of distinguishing between a perception and its immediate object, the problem for Mr. Broad is as to the relation of this immediate object to the 'real' in the physical world. His definition of 'real' is to be gathered from the following passage: "Whatever else may or may not exist, it is quite certain that what we perceive exists and has the qualities that it is perceived to have. The worst that can be said of it is that it is not also *real*, *i.e.* that it does not exist when it is not the object of someone's perception" (p. 3). That is to say, the 'real' is what does not exist only when it is perceived. Much might be said in criticism of this definition, but it is at any rate clear and definite. He formulates two questions immediately after giving this definition, namely (*a*) do objects of perception themselves continue to exist at times when they are not perceived? and (*b*) do things exist which are not perceived but are inferrible from

perceived objects and have some relation to these objects such as could be called 'correspondence' with them? In the main, the first chapter rejects (rightly as I think) such arguments against realism as are familiar from Locke and Berkeley. But the different visual appearances of a given thing from different places lead to the conclusion that touch is a sounder source of knowledge as to shape than sight. This conclusion is adhered to throughout the rest of the book. The ellipses of various eccentricities which are seen from various places in looking at a circle cannot, Mr. Broad thinks, be *all* real, not because such a view would be logically impossible, but because it would be so terribly complicated (p. 41).

I think that we have here the first effect of an undiscussed dogma which is embedded in Mr. Broad's conception of 'reality'. What makes Mr. Broad call unperceived objects 'real' is not the mere fact of their being unperceived, but the supposed fact that they persist. He seems, in fact, to work with the notion of substance,[1] with the belief that the physical world must consist of permanent entities with changing relations. I think the contrary view, that permanence is constructed, and is that of a temporal series of successive existents, makes the relation of the object of perception to physical reality much simpler. We can then hold that, although we do not perceive everything, all that we do perceive is 'real' in the only sense in which anything is 'real'. All the visual ellipses 'corresponding' to the one tactual circle are 'real' while we see them, and nothing that exists (so far as our evidence goes) persists for very long. This view is not more complicated than the view that denies 'reality' to the visual ellipses. For on Mr. Broad's view they exist, and must have their place in an inventory of the world; but on his view there is something else of a different kind, more 'real' than they are, whereas on the view that I should advocate there is nothing more 'real,' though there may be many things which we do not perceive.

There is a very good discussion (p. 45 ff.) of the reasons which make it impossible to know that such words as 'red' and 'green' have the same meaning to two different people, but possible to know that such words as 'agreement' and 'difference' have the same meaning. The point is very important, and I do not know of any author who has made it so well.

The second chapter is "On Causation; and on the arguments that have been used against causal laws". It begins by stating that it will assume the validity of arguments from probability, and of induction as a means of establishing probability. There is in the early part of the chapter a certain amount of discussion of somewhat familiar themes, such as whether a cause is a thing or an event, and whether a cause is to be interpreted in terms of activity or of regularity. Naturally the regularity view is adopted. Equally

[1] This notion is rejected on page 103, and is certainly not *intended* to be assumed anywhere. But I think it is 'real,' *i.e.* exists when Mr. Broad does not perceive it.

naturally, it is decided that transeunt causality is quite as possible as immanent causality (p. 105). The discussion on "causal laws and time" (p. 106 ff.) is to my mind unsatisfactory because it seems to assume the continuity (or at least the compactness) of change, not merely as applied to the world as a whole, but also as applied to small portions of the world. If, as I believe, whatever exists persists for a finite time (however small), the truth must be more like the modern physical theory of *quanta*. Continuity, like permanence and everything else that is mathematically convenient, will be a matter of logical construction. This, if it be the case, compels a somewhat new discussion of such questions as the temporal contiguity of cause and effect. Something like this view is discussed on page 114, but in connection with what I should regard as an unduly conventional theory of time and space.

It is often thought that, when an effect is complex, its cause must be equally complex. A sound, for example, has the characteristics of pitch, loudness, and quality. Must the cause of the sound which we hear have three corresponding characteristics? Mr. Broad shows that there is no ground for thinking so (p. 159). The point is important from its bearing on the possibility of mechanical explanation in general.

The conclusion of chapter ii. had better be given in Mr. Broad's own words, as it would be difficult to state it either more briefly or more clearly:—

"That every event has a cause means on our theory that to every true proposition asserting the occurrence of an event at any given time there is a number of true propositions asserting the occurrence of other events at different (and perhaps, to be in accord with tradition, we should add earlier) times such that relative to this set the probability of the event's occurrence is 1. This proposition does not seem to me self-evident, nor do I know of any means of proving it. At the same time it obviously cannot be disproved and it is advantageous to assume it as a methodological postulate" (p. 161).

I can find no criticism to make of this statement, given the author's apology as regards probability (p. x.). I feel less convinced as regards what we are told (p. 114) is an *à priori* truth, namely, "the law that a system that has been quiescent for a finite time can only be set in motion by a causal process transeunt to itself"; but in view of the fact that no instance of a quiescent system is known, the question is perhaps not of great importance.

Chapter iii., "On phenomenalism," discusses the views of Mach, defended, not by Mach's arguments, but by those much better ones which Mr. Broad would advance if the views were his. Phenomenalism is defined as the theory which "holds, not merely that the objects of all our perceptions exist only when they are perceived, but also that there are no permanent real things with laws of their own that cause these perceptions and in some measure resemble their objects" (p. 164). It is pointed out

(p. 165) that this theory is incompatible with the causal theory of perception, according to which our sense-organs are part causes of our perceptions. For if phenomenalism is true we have no eye except when some one sees it, and therefore what we see when we are not under observation cannot be caused by the structure of the eye. This is a perfectly irrefutable argument. It does not provide any ground against phenomenalism, but if phenomenalism were otherwise acceptible it would afford a ground against the causal theory. It does not *prove* that it is impossible to deduce phenomenalism from the causal theory, since there is no fallacy in using a false premiss for the purpose of proving its own falsehood. The one thing it does prove is that phenomenalism and the causal theory cannot both be true; and this is important, since those who believe either generally believe the other, and the two together (though both cannot be true) are far more plausible than either separately, though either separately may be true.

This chapter does not seem to me very satisfactory. "I think it is perfectly clear," says Mr. Broad, "that an absolutely pure phenomenalism that wishes to explain and anticipate our perceptions can be ruled out of court. We will suppose that it is allowed to assume present perceptions and those that it can remember. It is quite clear that with these alone there are no causal laws possible that will account for the perceptions we may expect to have anything like as well as the assumptions which science makes will do" (p. 168). This certainly *seems* true; but is it? I am troubled by an argument which needs to be tested by practice, but which meanwhile I will advance with due hesitation. My problem is: How can we ever obtain any evidence for a causal law except through perception? And, that being so, must not the unperceived elements in such a law be definable as functions of the perceived elements? And, in that case, do these functions serve any vital purpose except *as* functions of perceived elements, and is there any reason to suppose that they represent independent reals? It seems to me that a world sparsely dotted with perceived elements can be "filled out" in the same kind of way in which a descriptive space is filled out until it becomes projective. The elements added will be functions of the elements given, just as are the "ideal" points, lines, and planes that are added to a descriptive space in constructing a projective space from it. The assumption that the ideal elements "exist" is, it seems to me, theoretically otiose, and merely convenient as affording resting-places for our feeble logical imagination. I grant at once that undiluted phenomenalism cannot yield as well-filled a science of physics as we are accustomed to, but I contend that what would have to be omitted represents mere prejudice or guess-work, for which there is no shred of empirical evidence. If all this is true, it does not, of course, prove that phenomenalism is true, but only that it cannot be shown to be untrue, and that it is the most economical of all the theories that may be true. The prudent philosopher, it seems

to me, will no longer aim at finding one certainly true complete theory in any subject: he will be more likely to find that an infinite number of theories are compatible with all the data, and he will assert only the common part (if any) of all these theories. In the problem with which we are concerned at present, this common part, I suggest, is what is *positively* asserted by phenomenalism. I do not say this is certainly the case; I merely think it may be, and Mr. Broad has not shown that it is not.

Chapter iv., a very long chapter, is on "The causal theory of perception". This theory, to begin with, is described as "the view which is certainly held vaguely by educated common-sense that our perceptions have causes and that some relation is to be found between the nature of these causes and the reality of the objects perceived" (p. 187). He suggests (*ib.*) that this theory *may* be a will o' the wisp, but he certainly does not succeed in proving that it is. He distinguishes it from the "instrumental" theory, according to which our sense-organs under suitable circumstances are instruments for perceiving reality, while under other circumstances they lead us to illusion. This theory, after considerable argument, is criticised, mainly on the following ground:—

"Grant that there is illusion whether small or great and you must grant that the complex mechanism involved in perception can produce two entirely different results. Entirely different in one sense and yet on the other hand unfortunately very much alike. It is the combination of their extreme likeness and their utter difference that threatens to wreck the instrumental theory, and with it, the science of physics as ordinarily understood. When we perceive reality, if we ever do so, the effect of the whole process in the reality, the organ, the brain, and the mind is to establish a relation between the mind and the reality that we perceive. When we perceive appearance, the effect of much the same process in the organs and the brain is to produce, not a relation to something already existing, but a whole of object + relation to mind. Now two effects could hardly be more unlike than this. Yet on the other hand there is an immense likeness between them" (p. 240).

This leads up to the question: "Can you really believe that practically the same mechanism can produce such utterly different results?" Nevertheless Mr. Broad does not *entirely* accept the conclusion to which the argument points. He adheres to the view that in touch, at least, we become acquainted with primary qualities which resemble those of their causes—not, oddly enough, their immediate causes, but others far enough back to be also causes of the visual appearances of the "same" things. The scientific theory of the causation of our perceptions, he points out, "assumes that the remote causes of our perceptions resemble their objects not only in the general way that both have primary qualities, but also in the much more particular one that there is a general resemblance between the shape of the appearance and the shape of

the remote cause" (p. 245). The queerness of such an assumption is fully recognised, but nevertheless, with limitations, it is allowed to be reasonable as regards tactual shapes (see p. 262). The final statement is as follows :—

"Our conclusion, then, is that it is most probable that there is a real counterpart corresponding point for point to what is perceived in most (perhaps in all) the tactual perceptions that we have of figure, though doubtless more differentiated than the tactual objects themselves; and that events in this reality are the causes of our visual perceptions, according to laws which science, stating its position in terms of perceptible primaries, is able to discover" (p. 265).

For my part, I cannot believe that a conclusion of this sort can represent the truth of the matter in its simplest form. The whole theory seems to me unduly ingenious and complicated in its developments, too much *ad hoc*, and too destitute of a large simple structure. It reminds me of the successive epicycles by which the Ptolemaic astronomy was emended before it gave way to Copernicus. Whatever the truth may be about perception and reality, I feel convinced that, as in Copernican astronomy, the difficulty of discovering it lies in a difficulty of imagination at the beginning, not in subtleties at late stages of the development. Mr. Broad's book produces upon me the impression of listening to a long cross-examination of a plausible witness by a highly-skilled barrister, Mr. Broad himself fulfilling both rôles. At first the witness's story seems quite straightforward. Gradually little points are elicited, none of them fatal, but each requiring a more or less unplausible addition to the original evidence. At the end, though the story has not been actually refuted, we are left with an uneasy feeling that it is wrong from beginning to end. My own firm conviction is that all the conceptions traditionally employed—reality, perception, cause, matter, space, time, mind—need such radical overhauling that theories stated in terms of them can hardly be judged at all until they have been translated into new language and vitally transformed by the translation. But so long as the traditional conceptions remain unchanged, I do not see what better discussion is possible than that to be found in Mr. Broad's book.

The last chapter, on "The laws of mechanics," is less important than its predecessors. The author is entirely justified in his criticisms of the present reviewer's arguments in favour of absolute motion, which is neither logically necessary nor logically impossible, but on grounds of economy should not be employed in stating the laws of mechanics. The subject of Newtonian dynamics is hackneyed, and it is difficult to say anything very new or very interesting within the framework of the traditional conceptions. We could wish that Mr. Broad had given a more important position to the principle of relativity, instead of relegating it to an appendix. Moreover, even concerning Newtonian dynamics, there are things to be said which we should have wished to find. Take,

for example, the first law of motion. It may be a definition of equal times, or of all sorts of things. For my part, I should regard it as a definition (or a way of reaching a definition) of the "same" thing at different times. This cannot be obtained from continuity alone, as may be seen by considering a sensibly homogeneous fluid. But this topic is too large for the end of a review.

Mr. Broad's book preserves a uniform level of very high excellence. There is not one foolish word in it; everything is clear, definite, and well reasoned. But one could wish that he would apply his immense abilities to the invention of genuinely new theories, rather than to the fitting together of an extraordinarily ingenious mosaic of bits of old theories. His book is exceedingly useful as showing the best that can be done in that way; but I do not believe it is the most useful book he is capable of writing.

B. RUSSELL.